Against Individual Creativity

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Abstract

In this paper I discuss reasons for viewing human creativity more as a social process than as an individual act. These reasons include the subjectivity of evaluation in attributing creativity, the potentially arbitrary relationship between individuals and creativity at the cultural level, the importance of the capacity for preserving cultural information over and above the capacity to innovate, the role of objects, institutions and interaction in sparking creativity, and the social constructedness of creative domains. I consider the consequences of this way of thinking for research into computational creativity. I argue that realising the goals of computational creativity depends on integrating research on creative agents with social technologies.

1 Introduction

The Creative Ecosystems project[1] aims to investigate ways that computers can be treated less as tools and more as collaborative partners in creative processes, using a methodology inspired by the study of evolution by natural selection and the dynamics of ecosystems. Our research, therefore, directly faces the problem of defining these roles, and grappling with the epistemological issues surrounding what it means for something or someone to be responsible for the creation of something else.

Although social and cultural factors have been acknowledged, often generously, in computational approaches to creativity, this has always been in deference to a focus on the cognitive capacities of the individual (*e.g.*, Boden, 1990). Such a focus can be justified by the assumption that creativity is a problem that can be addressed directly by an individualist cognitive science[2]. The individualist approach welcomes culture as a part of the external environment of the system in question (for example, as input to the system (Spector and Alpern, 1994)), but proceeds in anticipation of a situation in which creativity can be observed *in* the system in question, following from the fact that we observe creativity as something that happens in individual humans. To be clear, the alternative – a distributed

[1]Australian Research Council Discovery Project grant DP0877320.

[2]Pearce and Wiggins identify creativity as an ill-defined problem, but many researchers, whilst acknowledging this, perceive individualist cognitive approaches as a research challenge with a clear goal.

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social approach – still treats the human brain as the key element in the system, but does not accept that a single human is a key originator of activity. Creativity occurs instead on a higher, social, level of organisation.

This paper stems from a number of personal discussions on the balance of importance between social processes, on the one hand, and individual cognitive processes, on the other, in introducing new artefacts and concepts into the world. I will argue from the point of view that in the study of computational creativity we still overestimate the importance of the individual as a distinct creative unit. Although scientists and philosophers may be used to viewing humans as machines, consciousness as illusory, and the quirks and idiosyncrasies of our not-obviously-rational behaviour as a product of turbulent evolutionary interactions, we still hold onto a view which identifies individual humans as the only significant units of creative agency. Scientifically and technologically, there is greater scope for the development of a holistic approach to computational creativity that finds a more appropriate balance between the social and the individual (i.e., it needs to be shifted further towards a sociological perspective).

1.1 The ratchet of cumulative cultural change

In the introduction to the book *The Cultural Origins of Human Cognition* (Tomasello, 1999), Michael Tomasello presents a rich scene of human cultural evolution that sets the tone of the present argument. The central phenomenon that Tomasello addresses is familiar to anyone interested in human creativity, expressed as follows: in humans, we observe a process of *cumulative* change over historical time, not evident in any other species (at least, to anywhere near the same degree). The evolution of humans over the time scale in question (say, the past 10,000 years) is predominantly cultural, as opposed to genetic. Tomasello describes this process with the metaphor of a ratchet, where cumulative cultural change is caused by the two phases of the ratchet's action. The first is that new behaviours (words, ideas, artefacts) are introduced. The second is that some of these introduced behaviours are captured and maintained across generations, providing a platform upon which further behaviours can be built. The ratchet is the combination of these elements; accumulation is achieved by allowing new elements to be found, and saving old elements from being lost. The history of all technology, all language, all scientific knowledge and all art provides ample evidence of this process. Newton captured this more succinctly in the metaphor 'standing on the shoulders of giants'.

The ratchet concerns the structure of social interactions (and therefore social cognition); it does not specify what kinds of force drive us forward in the direction that the ratchet allows. In this it hints at the possibility that human creativity could be *more* about social phenomena than about individual creative potency. Ratchets have the property that they turn random walks into directed walks, and by this reasoning, quite 'uncreative' behaviour in humans can in principle power very creative processes on a cultural level. But the ratchet metaphor goes only so far, since clearly we can demonstrate the existence of creativity

in the absence of social behaviour; crows in laboratory experiments have proven to be sophisticated problem solvers[3], and humans demonstrate even greater problem solving skills than crows; there is no denying human problem solving ability and thus individual human creativity. The position against individual creativity is an argument that the processes contributing to creativity on a societal scale are of even greater significance. At this level, it is not clear what combination of social structures and basic cognitive capacities give rise to the things around us, but it is clear that the capacities associated with solving problems are just a part of the story.

The following section characterises a number of positions that favour a global sociological view of creative behaviour.

2 Arguments against identifying creativity in individual humans

2.1 The 'subjectivity of evaluation' argument

Following Csikszentmihalyi (Csikszentmihalyi, 1996), individual creative acts are only established as being creative by a wider social group, and creativity must be understood as the product of the interaction between the individual, the domain of activity, and the social group involved in that activity (the field). Csikszentmihalyi argues that it is impossible to conceive of an objective measurement of creativity based only on the action of an individual with respect to an existing domain. We have no objective grounds upon which to determine how creative something is, and must rely on individual responses to the behaviour in question, such as collective or expert evaluations. Therefore, an evaluation of creativity must be the result of a group's response to the individual's activity. Correspondingly, Csikszentmihalyi defines creativity as the process of changing a domain. A domain can only be changed if the group of individuals involved in that domain enact that change. Csikszentmihalyi's argument is pragmatic in one respect: we may never know what cognitive processes made Einstein and Picasso creative, and perhaps they were not even particularly special individuals, but we can be certain that the social response to their work was essential in determining them as creative and in establishing the centrality of their work in a newly modified domain: it was a group effort.

This subjective perspective could be written off as a cosy compromise hiding a deeper objective truth about human creativity. The problem with it seems to be that if Picasso and his works had been kept locked up in a dark room, then this social point of view apparently draws the conclusion that the hidden-away Picasso was not as creative as the real Picasso. This seems counter-intuitive, and worse, unfair. There is surely something important to say about such neglected brilliance. This issue lies at the heart of the difference in perspective

[3]it is also the researchers who are creative for discovering problems that these crows could solve; before the behaviour is identified in the wild, this is actually a case of crow-human collaborative creativity.

between an individual and social view of creativity. From the social point of view, the 'fairness' complaint treads a dangerous path by implying that there exists such a thing as a fair evaluation of creativity. Counter to this, it can be argued that if creativity were measured objectively, we would have no means to verify the measurement except by asking people. Creativity is *logically subjective*, even if we do come to build successful creativity-measuring systems.

A socially empiricist perspective also demands that we specify precisely what this hypothetical "frustrated creativity" is. The imaginary Picasso's creativity cannot be imagined as creativity unless we can imagine it affecting a domain (in an alternate reality), moving people and inspiring them to think in new ways. There is nothing wrong, from the social perspective, about hypothesising that a person *would* have had a great cultural impact, had certain things been different. In so far as the hypothesis has support, it may be appropriate to call the person creative, despite the above definition, by insisting that frustrated creativity is as good as realised creativity. It is worth noting the everyday nature of such questions, and the variety of measurements that apply. It is not uncommon to hear a critic insisting on the greater importance of a lesser known artist over a more famous one, or contributing new evidence to our understanding of how certain individuals influenced certain movements. Neither fame, nor commercial worth, nor quantity of output are necessarily important in determining *impact* in this abstract sense, and even when considering impact, there are complications involved in correctly accounting for the origins of styles and ideas.

The value of a social view is that it allows for distributed and fuzzy origins. It is fruitless to try to rank the creativity of our great artists except by treating them as culturally situated agents. And as culturally situated agents, these artists are embedded in a process of interaction and interdependence with their entire cultural environment.

2.2 The 'creative only in hindsight' argument

The subjectivity argument is both a practical and logical position with regard to interpersonal evaluations of creativity. In computational creativity we consider the output of successful artists as an ideal target, but we need to consider the entire process that produces both the artwork and the collective reverence for that artwork. Now consider the most extreme version of the social position: all individuals are equally uncreative, but historically we come to perceive greater creativity in individuals who, by some lottery-style process, rise to the top of the social ladder. In other words, imagine that Bach's initial fame came by chance, but the fame, once established, triggered a feedback effect by which we came to perceive his work as greater and greater: something of a winner-takes-all process.

It is possible that the contemporary idea of celebrity acts as a good model for how we determine our great artists. It takes certain qualities to be a celebrity – good looks, confidence, etc. – but there is no shortage of candidates who possess these qualities. Who becomes a celebrity may be small part meritocracy, and large part lottery. In similar economic terms, it may be that there is no scarcity of *potentially* great art, but rather

oversupply coupled with a natural limit on the number of artists we call great, and the greatness we attribute to them.

This is not an argument that all people are equally capable of exhibiting the qualities of great artists, but that the use of the term 'creativity' as an umbrella for a set of individual qualities is unproductive, as is the use of landmark artistic figures as reference points for establishing an understanding of creativity, except if their social environment is accepted as contributing to their achievements. An individual is, in part, a product of feedback through social interaction: a scholarship at a university, for example, feeds previous success back into future success. This implies that the qualities of creative people can be realised after the social establishment of their success.

By this argument, no one set of qualities sums up creativity, although all individuals may exhibit creative potential through the shared traits of human intelligence. People come to exhibit many different qualities through their social situatedness that can be put into action to support creativity at the cultural level. In this way, creativity at the cultural level even acts to modify, over time, the kinds of traits that are seen in creative people. This is even evident in the history of usage of the term 'creative'. According to Williams (1983), creativity was originally only attributed to God, then later with certain human activities, in particular poetry. Throughout the 18th and 19th centuries, it went from referring to special cases of artistic brilliance, still associated with divinity, to a general attribute of artistic activity. Today it is recognised as a psychological capacity extending well beyond the realm of artistic activity, whilst at the same time delimiting a certain set of activities associated with the arts: the creative industries.

2.3 The 'capacity for culture' argument

The 'capacity for culture' argument states that it is our capacity for culture, such as successful social learning and imitation, that makes the emergence of new artefacts possible, and is the powerhouse of this emergence: individual innovation approaches negligible significance in comparison to these social capacities. In Darwinian terms, this means that the mechanism for heredity is more important than the mechanisms for variation; as long as some new cultural entities are conserved occasionally, and as long as there is variation, then evolution will take place. The mechanisms for identifying successful strategies and learning them are the cognitive cornerstones for human cultural evolution, but much of the further detail needs to be understood in terms of the dynamics of human social interaction in constructed cultural contexts. This fits a view of human historical change in which increased potential for variation through language, technology and infrastructure has led to an increased rate of creativity.

Dissanayake (2000b) provides many examples of phenomena from one aspect of society driving change in others. For example, new notions of representation implicit in using a symbolic rather than iconic written system allowed new theological concepts to emerge in ancient Greece. Libraries, more recently, although involving only a change in infrastructure

without explicit technological innovation, created scenarios in which scholars could cross-check sources easily for the first time, leading to dramatic increases in the accuracy of texts and maps. These are all cases where social contexts foster specific individual creativity, but which are primarily driven by the human capacity to reproduce and maintain cultural information.

2.4 The 'creative agency' argument or 'invisible hand' argument

Human brains play a central role in these processes of idea manipulation and development, but require other objects and processes that are clearly outside of us, a point that has become central to the extended mind philosophy of Clark (Clark, 2003). It is quite possible that we underestimate the importance of external processes in generating new ideas. To take an extreme social position, ideas are not had by individuals but by cultures, and inventors are simply the scribes who note them down (perhaps making the final connection in a string of collective reasoning). Put another way, at the point when a person has an idea, he is merely converting a now patently obvious fact into a human-readable symbolic form.

It is often casually observed that many instances of creativity occur through interaction rather than internally. This includes interactions between humans and artefacts. In such cases it is no longer self-evident that we can identify the individual as the source of the creative product. For example, conversations about creative practices in art and music often make reference to the process of seeking inspiration from the materials one is working with.

This is an appropriate subject to be understood by anthropologists, and although anthropology failed to made a significant contribution to the theory of art throughout the twentieth century, the posthumously published work, *Art and Agency*, by Alfred Gell (Gell, 1998) is cited by many as a turning point (Gell died in 1997 having just completed the book). Gell attempts to generalise a set of relationships between different combinations of people and objects such as artist, materials, artwork, curator or commissioner and audience. In particular, he emphasises the potential for materials to inspire artists as being as significant as artists manipulating materials. Likewise, more readily, artworks (objects) influence their audience (people) in the absence of the artist. Typically we recognise the artwork as embodying the communicative intent of the artists, but of course we have no guarantee that this is the case: artworks speak for themselves, and artists commonly desire this.

Gell also proposes "the notion of a 'corpus' of artworks as a kind of spatio-temporally dispersed 'population', where such a corpus is a product of what he calls the 'extended mind' – that is, externalized and collectivized cognitive processes" (Born, 2005, p.20). It is interesting that Gell proposes an extended mind, an idea which was popularised independently by Clark and Chalmers in the same year. This suggests a strong compatibility between the intellectual lineages of anthropology, as the study of culture above and be-

yond a psychological perspective, and theories of embodied situated cognition, both of which question the lingering causal favouritism associated with 'mind'. By Gell's account, we are as much products as producers: products of biological evolution, cultural transmission and of a constructed heterogeneous environment full of artefacts and institutions (which can be understood equally as cultural transmission through objects, or as niche construction).

A hundred years before Gell, Durkheim had clearly established this distributed nature of cultural processes:

> "it is obviously impossible... for the phenomena characteristic of life to exist in the atoms of hydrogen, oxygen, carbon, and nitrogen. For how could the properties of life exist within inanimate elements? ... Let us apply this principle to sociology. If, as we may accept, the synthesis *sui generis* which every society constitutes yields new phenomena, differing from those which take place in the individual consciousness, we must also admit that these facts reside exclusively in the very society itself which produces them, and not in its parts." (Durkheim, 1972, p.69)

Gell's account frames art from this essentially systems perspective, seeing that it's basic properties cannot be reduced to individual acts of cognition, perception and creativity, and bringing us to the apparent extreme that inanimate objects are effective agents. According to Latour, a pioneer of this form of analysis, "we must learn to attribute – redistribute – actions to many more agents than is acceptable to either the materialist or the sociological account. Agents can be human or (like the gun) nonhuman, and each can have goals" (Latour, 1994, p.33)[4]. Alternatively, as Latour explained, we can see agency at higher levels in transient networks of people and things: "Who, then, is the actor?... Someone else (a citizen-gun, a gun-citizen)" (Latour, 1994, p.32). Latour also suggests that the mind can not only be seen as extended, but also subdivided.

Malafouris (2007) elaborates on the hidden essentialism of viewing humans as the only conceivable agents. Our experience of the world mediated through consciousness naturally lends support to the theory that humans possess a special form of agency. Malafouris argues for the need to rid ourselves of this bias, and introduces the concept of 'material agency' as a kind of challenge to it: "If human agency is then material agency is, there is no way that human and material agency can be disentangled. Or else, while agency and intentionality may not be properties of things, they are not properties of humans either" (Malafouris, 2007, p.22). Rather than an invisible hand, Malafouris refers to "the grey zone where brain, body and culture conflate" (Malafouris, 2007, p.22).

It is easy to cast off these arguments as having little to do with the challenges of computational creativity. We know what good art looks like, so we have the tools we

[4]Latour is referring to a debate between the USA's National Rifle Association (NRA) and anti-NRA groups. The latter ran a campaign with the slogan "guns kill", to which the NRA's repost was "guns don't kill, people kill".

need to evaluate the creativity of our systems, and greater objectivity can be achieved, if so required, by employing multiple subjects to evaluate a system's output. But it is important to respect the origins of the theories discussed above as being products of a body of research that uniquely studies culture *in the wild*, requiring fundamentally different research tools, and leading to a fundamentally different world view from the various lab sciences. A valid objection that emerges from an anthropological viewpoint is that 'good' (even 'subjectively good given my cultural context') is simply too narrow a way to look at art, and far too imprecise a target for developing an understanding of creative systems. On the positive side, computational creativity researchers might consider embracing a notion such as material agency, since it is precisely in keeping with the objective of building creative machines – manmade objects that contribute in unforeseen ways in the cultural process. Material agency complements the question of how to build creative agency into machines, with the question of how machines will, or already have, become established as active agents in processes of creativity at the cultural level.

The other side of the material agency point of view, already alluded to in this discussion, is that individuals are highly conditioned by their interaction with their environment, both social and physical. In terms of artistic creativity, for example, the earliest innovators in a new medium may find themselves in fertile creative domains, even though they may turn out to be doing really quite predictable things in hindsight. Technologically driven arts initiatives, such as those working with RFID tags, LEDs or 3D printers, seem to commonly evoke to this problem. If we felt that such a person was simply more fortunate for being in the right place at the right time than actively creative, but that the resulting product was, nevertheless, novel and valuable, then we clearly have a gap in our creative accounting. The missing credit might be assigned to scientists or inventors or any other individuals involved in developing the new medium, but arguably if we take the idea of 'accounting for creativity' seriously, then we cannot always do so though lineages of individuals, or the creativity of individual brains. Thus the relevance of Malafouris' argument that the compulsive attribution of creativity entirely to humans may actually be the workings of a kind of folk cognitive science. An evolved tendency to reward innovation might have led to the exaggerated assignment of phenomena to individual human agency, as is evidenced in beliefs in witchcraft and supernatural ancestral agents, or, for that matter, the assignment of personality to large groups of individuals such as nations. As an alternative, an 'invisible hand' approach to this kind of creative accounting may be more relevant to developing a scientific understanding of creative agency.

Similarly, collaborative creative activity between a number of participants 'bouncing ideas off of one another' leads to outcomes that could not have originated from single individuals. Contemporary practices such as improvised music may typify the use of this notion of emergent creativity most explicitly, but whole artistic movements also seem to embody this principle too in the way in which they guide individual choices. Thus alongside a theory of appropriately measured novelty to explain the clustering of styles into genres, we can also think of genres as being collectively engineered cultural domains which ground

or envelop individuals. By this reasoning, individuals don't actively desire novelty, but instead seek to engage with a cultural domain, which may or may not require novelty (typically, for example, we associate Western art with strong, possibly increasing, demands for novelty). Genres provide a backdrop of contexts and functional constraints upon which individual artists elaborate. This may involve general processes such as exaggeration, fusion, juxtaposition and analogy, governed by discoverable laws (as demonstrated, for example, by Martindale (Martindale, 1990)).

2.5 The 'creative domains as constructed niches' argument

> "Today it is recognised that the human species has had an evolutionary history of about four million years. Of that time span, 399/400ths is disregarded when it is assumed that 'human history' or the 'history of art' begins, as it does in our textbooks, about 10,000BC." (Dissanayake, 1988, p.5).

It is becoming increasingly relevant to understand music and art from an evolutionary perspective, particularly in understanding the social factors which make sense of human creativity in the arts. This is important for framing the goals, measurement and findings of computational creativity. The arts may, perhaps, have an important social-political function (Dissanayake, 1988, 2000a; Hagen and Bryant, 2003; Cross, 2003, 2007; Cross and Woodruff, 2008). They may enhance our general intelligence (Cross, 1999; Dissanayake, 2000a; Mithen, 1996, 2005). They may exist as a result of sexual selection (Miller, 2000), or simply as a kind of drug (Pinker, 1998). Whilst these theories are busy areas of research, background debate in computational creativity implies a function or service provided by the arts to society (e.g., Colton, this collection). However, if either of the latter two theories (Miller's or Pinker's) are correct, this is hardly a tenable position. In terms of its benefits to society, computational creativity would be no more lofty than plastic surgery, or technological developments in sports car design or synthetic recreational drug development. On a more general level, human cultural behaviour, even if it ultimately provides a basis for mass cohesion, is clearly highly competitive. Dunbar (2006), for example, has lucidly demonstrated how vocal communication shares traits with, and correlates well to primate grooming patterns. Grooming is used as an honest signal to form allegiances, requiring intensive time investment but with significant gains in establishing inter-individual bonds. Whilst cooperative on a local level, these bonds ultimately serve individuals in social competition on a large scale. It is the pressure of social competition, Dunbar argues (Dunbar, 1998), that drives the process.

Dunbar's theory does demonstrate the success of humans (using the one-to-many feature of language and its communicative descendants) to build cohesive groups of larger and larger sizes, up to the monumental scale of modern nation states (although cohesion, 'the formation of a united whole', does not mean 'to the mutual benefit of everyone'). Even if they involve intense internal competition, overall they may be hugely successful systems.

Recent research in the biological origins of music suggest how music could fit into this picture. Parncutt (2008) points out that sound is the only medium that straddles both the pre-natal and post-natal environment. Whilst in the womb, we have a direct link through hormone transfer to the emotional experiences of our mother. Simple associative learning, therefore, between hormonal experiences and the sounds accompanying these experiences, could explain how sound comes to connote certain emotions once we are born.

Hagen and Bryant (2003) propose a social function for music also based on costly signalling[5] in which knowledge of a musical style indicates membership of a group. The costly investment by individuals comes in the form of learning complex patterns – rehearsal – involving group performance. These performances would also indicate to potential enemies how *cohesive* the group was, suggesting something of their collective fighting ability. It follows that groups would establish coordinated patterns that were hard to learn, and that more musically talented individuals would be at a slight advantage in those groups (having to invest less time learning), leading over time to the evolution of increased musical skill, at the same time as increased complexity in group performances. Brown (2007) proposes a theory of contagious heterophony, in which a precursor to both music and language would have been a form of collective vocalisation similar to the collective howling of wolves (which is both contagious, and heterophonic, i.e., it doesn't require any temporal synchrony). Over time, this heterophony could be replaced by more temporally structured forms: homophony or synchrony (in music) and alternation (in language), fulfilling the respective functional requirements of these modes of communication.

As with Parncutt's theory, Hagen and Bryant's theory also identifies cooperative behaviour originating in kin selection, where it is plausible for individuals to substitute direct self-interest with an acting interest in the perseverance of the genetic survival of their closest kin.

In these theories, the arts are arguably powerful tools of social cohesion, but their existence also establishes the opposite: socially constructed environments in which individuals compete for greater social status, that is, exploiting the affordances of the cultural system. Individual creative ability, it appears, can only be understood in these hypothetical contexts as something that has evolved as individuals find new ways of exploiting the system for their personal gain, thus more as an unavoidable side effect of the social role of music and the arts, and less as a contributor to the socialising process. This both emphasises the individual nature of creativity but grounds it in a social evolutionary context, which provides motivational forces for creative behaviour.

Extending the competitive nature of artistic behaviour, another view is that the creative domains are purposeless spin-offs of the kinds of cognitive adaptations that allowed humans to begin accumulating behaviour across generations: an emergent game driven largely by

[5]The evolutionary importance of understanding communication in terms of honest or costly signals, otherwise known as 'The Handicap Principle' (Zahavi, 1975), is now pretty much universally recognised. Explanations of communication as a mutually beneficial behaviour must always account for the individual gains made by exploiting such a situation.

competition in constructed environments. There are three versions of this theory, the first two of which have already been mentioned above. The simplest, and least relativistic, is that our artistic fascination comes from a combination of cognitive traits which we have learnt to stimulate in new ways, just as new recipes push the stimulation of our taste-buds beyond the tastes present in environment in which they had evolved (sometimes with negative consequences such as obesity). Another explanation associates the arts and music with sexual selection, which is a convincing theory because sexual selection is particularly apt at explaining some of the most baroque phenomena of the natural world (Miller, 2000). For example, musical ability may indicate a functional brain, and dancing ability may indicate good stamina, co-ordination or symmetry.

An alternative theory exists that proposes similar dynamics to sexual selection but in non-sexual terms that are very specific to human behaviour, resting instead on the consequences of capacities for social learning. Research into evolutionary theories of status and prestige in human societies suggest strong currents of positive feedback in which specific stylistic behaviours are raised in importance through the status of their proponents, but in turn raise further still the prestige of their proponents. Henrich and Gil-White (2001) offer a model in which prestige is maintained and potentially exaggerated through a feedback process in which high prestige individuals demand a higher premium for access to the knowledge that is responsible for their prestige. The feedback loop is completed by the fact that, through this process of reward, any behaviour can become prestigious, with even arbitrary behaviours becoming prestigious as long as they are learnable, non-functional, individualisable and salient.

Thus we can imagine an evolutionary process which begins with basic capacities for social learning facilitating cumulative culture. Over time, cumulative culture increases the dependence of individuals on other individuals as sources of behavioural knowledge. There is selection for cognitive skills to help individual determine who best to learn from. At the same time, social feedback emerges in the form of rewards for good or valuable behaviour. As a result of this social reward, it is now possible to make a living out of 'convincing' others of the value of even useless behaviours (this needn't be an intentional or active process), even to the point where arbitrary behaviours have become so important in cultural life that they are indispensable (Bown, 2008).

Thus creative domains such as the arts, and their various genres, may be constructed environments in which the appearance of human creativity is a self-fulfilling prophecy, contingent on the reinforcement of value caused by this process. In order to identify how individuals achieve creative prestige in this environment, it is important to understand the backdrop created by this macroscopic social process. We can seek ground truths regarding the role of human creativity in the arts through the evolutionary psychology of social bonding and competition for status.

3 Implications for Computational Creativity

This anti-individual view of creativity points to two goals for computational creativity in the arts. On the one hand, computationally creative systems need to be social systems in order to achieve the kind of creative behaviour that humans exhibit. But, on the other hand, computational systems can be creative in particularly non-human ways in contributing to cultural-level processes of creative change, as arguably they already do. In both cases, their efficacy depends on how successfully they engage actively with the "webs of significance" that humans are caught up in (i.e., how they modify creative domains). Accordingly, the interaction between creative systems and the cultural systems they inhabit invites a distinction between a strong and a weak variety of creative systems. Strong creative systems are systems that resemble humans in that that play an active role in the generation of new things, with planning, problem solving and manipulation of the creative domain to accommodate their contribution. Weak creative systems are systems that are mostly passive but still act as agents driving change on a cultural level. This strong-weak scale is a measure of how active, goal-directed and strategic the agent is.

Historically, most manmade objects have been weak creative systems, but this does not mean that they have not contributed to creative processes at the cultural level. After all, most human goals derive from self-interest, or at least local interest, and as such any effect they have on processes at the cultural level cannot be understood in terms of goals at the cultural level. To reiterate the argument above, and as proposed by Gell, interactions between people and things can drive cultural change (possibly by 'sparking' creativity), and although the computational complexity may rest with the person, the origin of the creative output rests with both.

Similarly, acknowledging the importance of culture but treating it as a repository of information which is external to the creative individual is potentially misleading when one considers the loops of circular causality that are excluded in this formulation. Spector and Alpern (1994) propose that general purpose creative systems can be hand designed but gain cultural relevance by presenting cultural information as the input to the system (which might learn statistical features of the data, for example). There are no grounds to argue that this cannot be a fruitful approach, but from the considerations discussed above it seems more appropriate to consider a circular action-perception paradigm: achieving successful behaviour requires interaction.

From the perspective of creativity at the cultural level, therefore, it is possible that the most direct approaches to computational creativity, those that attempt to model the behaviour of practising artists, will have less long-term impact than the kinds of technological developments that are taking place directly in the marketplace of the arts: software that has major social impact such as systems for analysing features for the purpose of artist or genre classification, systems for protecting copyright and identifying copyright infringement, customer recommender systems, and tools for social collaboration. Of particular interest are tools that allow artists to share not only the final product of their work but

the tools and raw materials they used in the production of their work (for example, at the present time music editing software is beginning to emerge in browser-based formats, with the option to share projects on social networking sites). Here we see the modularisation of the creative process in a move towards increasing flexibility with respect to working relations and automation.

These tools are directly changing creative domains, redirecting the course of artistic movements, arguably to the point that they will eclipse some of the current questions of computational creativity, by redefining how we think of human artistic activity. Instead of autonomous artists, these agents take the form of autonomous shopkeepers, lawyers, curators, engineers and promoters. Although their creative agency may appear weak, these human roles do have a direct practical impact on the arts.

Could this last point actually be taken to show that the cultural-level perspective misses the point? It may be very well mechanising the creative 'industries' more and more, but researchers in computational creativity are surely most interested in the clearly defined range of activities undertaken by artists.

My speculative answer is that the notion of the mechanical artist will approach maturity in direct proportion to these socio-technological developments, which will have the effect of naturally accommodating broadly defined generative process in the arts. There are many very profitable areas of application using and driving social technologies in the arts. The changes caused by such technology will allow two things: firstly, the digitisation of artistic interaction, which will provide a platform for software agents to interact in a cultural domain and open the floodgates to hugely more sophisticated experimentation in generative art (more sophisticated because it breaks out of an individual framework); and secondly, the capacity to perform new types of sociological analysis and measurement of cultural movements, contributing to a theory of creativity and social process that may reveal misconceptions about human creative capacity, and also allow the impact of software artists to be genuinely 'evaluated'.

4 Summary

I have presented a series of short arguments for viewing creativity as a social phenomenon in which individual humans are active participants amongst a heterogeneous set of agents. I have attempted to view the study of computational creativity from a sociological extreme in order to consider the ways in which an inherent bias towards individual human creative agency might be latent in the subject[6]. This leads to certain empirical questions: how

[6]The arguments in this paper tend purposely towards relativism in an attempt to consider the extent to which a social view of creativity is valuable, and an invidiualistic view misleading. Relativism is dangerous when it slips into an endless regress towards its extreme, where no ground truths hold. But, critics should be wary of assuming this collapse to be taken as given. Sensible relativism is simply the acknowledgement that different individuals are privy to different ways of seeing the world, due to the background of their experience. The effects of these different ways of seeing the world can be quite powerful, because human

much chance is involved in the assignment of creativity to individuals? What aspects of our evolved psychology and social behaviour explain the existence of and direct the course of the arts? How predictable are the outcomes of the interactions between creative individuals and new materials and media? It also suggests some more pragmatic questions for computational creativity, in particular, how far can we go with the idea of 'accounting' for creative outcomes, by which I mean tallying the creative steps involved in the emergence of new things and assigning credit accordingly? Can we distribute the credit only amongst individual humans, or is it more helpful to think of an invisible hand at work?

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behaviour is so heavily influenced by other human behaviour, and humans pin their survival so heavily on successfully interacting with others in complex cultural systems. This is why it is reasonable to think of a significant amount of our world views as 'socially constructed', and of this construction, working at an individual level, as contributing heavily to the process of individual creativity.

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